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I, KIM MARSHALL, MANAGER EXAMINATION SUPPORT AND SALES, hereby certify that the annexed is a true copy of the Provisional specification in connection with Application No. PP 4753 for a patent by BYRON AUSTRALIA PTY LTD filed on 20 July 1998.

WITNESS my hand this Fourth  
day of August 1999

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PROVISIONAL SPECIFICATION

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Invention Title:

Quick-cook dehydrated vegetables.

The invention is described in the following statement:

### Quick-Cook Dehydrated Vegetables

Dehydrated vegetables are important items of commerce. They are processed vegetables in shelf-stable form and are used extensively in the food industry, particularly to provide colour, 5 flavour and nutritional benefits to a wide variety of dry packaged foods.

In the packaged food industry they are especially important in cup soups, cup noodles and in packaged rice and pasta dishes. These are convenience products and quick cook times are regarded as important. In many products the cooking directions call for the addition of 10 boiling water only, without further cooking. The use of vegetables in these products may require the use of expensive freeze-dried vegetables, or else very small dehydrated vegetable pieces. As the hot product may take about two to three minutes to cool sufficiently to be comfortable to consume, it is desirable that the vegetables be sufficiently rehydrated within this time. Conventional dehydrated vegetables, even small pieces, are usually still gritty after 15 3 minutes. Freeze-dried vegetables are expensive and often still spongy in texture after 2 to 3 minutes. For products cooked in the microwave or on stove top, a desirable cook time is as short as possible, preferably below five minutes. It is therefore highly desirable to have an economical dehydrated vegetable component that rehydrates quickly enough to be pleasant to consume after boiling water is added and allowed to stand for two to three minutes, and 20 rehydrates back to a natural tasting piece of vegetable.

Alternate quick-cooking dehydrated vegetables such as solute added products (US 4,683,141) or puffed vegetables (US 3,038,813) have been described, but neither appear to give products sufficiently quick-cooking for many convenience packaged foods.

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US 3,408,209 describes quick cooking dehydrated explosion puffed vegetables as described in US 3,038,813 and compressing them for the purpose of reducing their bulk for packaging purposes. There is no claim made that this reduces their cooking time.

The invention relates to a dehydrated vegetable product with a cook time of from almost instant to about five minutes.

The result may be achieved by mechanically compressing partially dehydrated vegetable  
5 pieces, as by passing between the rolls of a roller mil or by other means, to an extent whereby the pieces are noticeably flattened, but not to such an extent that they texture of the rehydrated product is unacceptably altered from that of a rehydrated vegetable piece which had not been compressed. the vegetable may then be further dried to a moisture content of about 5% or lower, or in the case of intermediate moisture products, to a higher level.  
10 Surprisingly, the compressed vegetable pieces, when rehydrated, return to much the same size and shape as the original pieces, but in a significantly shorter time.

Accordingly, in one aspect, the invention provides a dehydrated vegetable product which comprises a vegetable piece having a moisture content of 10% or less which has been  
15 compressed in one plane but still has a substantially intact cellular structure, which vegetable piece on being placed in water at a temperature of 90°C-100°C is capable of rehydration to its substantially original dimension and is of edible tenderness and texture within five minutes.

In a related aspect, the invention also provides a dehydrated vegetable product prepared by  
20 partially dehydrating vegetable pieces to a moisture content from about 8 to 25%, compressing the vegetable pieces, and thereafter further dehydrating the vegetable pieces to a moisture content of about 10% or lower.

In a further aspect, the invention provides a process for the preparation of a dehydrated,  
25 rapidly rehydrating, vegetable product by compression of a partially dehydrated vegetable product.

The invention will now be further described with reference to a specific preferred embodiment. In the embodiment, the vegetables are washed, cut to an appropriate size,  
30 blanched (for those vegetables requiring blanching) and placed in the dehydrator as for normal

dehydrated vegetables. Dehydration would normally be in hot air, but other forms of dehydration such as vacuum drying could be used. The cut may be dice, slices or julienne style strips. It is preferred that the thickest dimension should not be more than about 5mm.

- 5 The vegetables are partially dehydrated to a moisture content of about 8% to about 25%. At these moisture contents, the vegetable pieces, particularly when warm, are reasonably plastic. They are then compressed, preferably by passing through a roller mill similar to that used for flaking grains, or by other means. The rolls of the mill are set at a gap between about 0.2mm to 2.5mm. The roll gap will depend on the dimensions of the partially dehydrated piece. If 10 the moisture content of the piece is too high, the vegetable will squash on to the rolls of the mill. If it is too dry, it will shatter. The extent or fineness to which the vegetable is rolled will largely determine the cook time of the finished product. If the piece is rolled too finely, the cook time will be almost instant, but the texture may be mushy. The gap between the rolls will be determined by:
- 15 (i) thickness of the semi-dehydrated vegetable piece;
- (ii) the type of vegetable and the variety;
- (iii) the desired cook time;
- (iv) the desired texture of the rehydrated product.
- 20 Dried vegetables which have added solutes can also be prepared in this way. The introduction of sugars and salts is described in Australian Patent No. 532414 or by other methods. The solutes used are salts such as sodium chloride, sodium lactate, and sodium citrate or sugars and others. The addition of solutes to the vegetables further accelerates the absorption of water and shortens the cooking time. Vegetables containing added solutes may be rolled with 25 less structural damage than those without added solutes since the addition of selected solutes appears to influence the plasticity of the pieces.

After compression, the vegetable piece has been flattened to a degree depending on the reduction of cook time required. It is then further dehydrated to produce a shelf-stable 30 product. The final moisture content should preferably be 7% or lower. The further

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dehydration results in the rapid loss of moisture since the compressed product gives up its moisture very rapidly.

The compression of the vegetables results in greatly decreased rehydration time of the vegetable piece. Table 1 presents the effect on rehydration time of compressed dehydrated vegetables with and without the addition of solutes.

Table 2 shows the effect of the degree of compression during rolling on the cook time and texture of dehydrated onion.

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**Table 1**

Time allowed for dehydrated vegetables to stand in water at 90°-100°C to be sufficiently rehydrated and tender to be satisfactory for eating. All vegetables compressed through 15 0.5mm roll gap except peas which were rolled through a 1.5mm gap.

	<b>Vegetable Dimensions are before dehydration</b>	<b>Control Not Rolled</b>	<b>Rolled</b>	<b>5% Solute Added Rolled</b>
20	Tomato 10mm peeled dice	8 mins	4 mins	2 mins
	Onion 10mm dice	10 mins	3 mins	1½ mins
	Red Bell Peppers 8x8mm dice	6 mins	1½ mins	1 min
25	Sweet Corn whole kernels	10 mins	4 mins	3 mins
	Green Peas	8 mins	4 mins	3 mins
	Carrot 10x4x4mm dice	6 mins	3 mins	2 mins

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**Table 2**

Effect of degree of compression on rehydration time of 10x10mm dehydrated onion dice containing 5% salt on standing in water at 90°-100°C.

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	<b>Gap Between Rolls</b>	<b>Rehydration Time</b>	<b>Comments</b>
	0.3mm	below 1 min	Rehydrated pieces mushy
	0.5mm	1 min	Slightly mushy. Some loss of texture
	0.8mm	2½ mins	Crisp but well rehydrated
10	Unrolled control	10 mins	

By use of compression as described varying cook times can be selected for vegetable pieces of almost instant, upwards. The cook time can be varied for each vegetable by adjusting:

1. The initial size of the vegetable piece.
- 15 2. The degree of compression.
3. The addition of solutes.
4. The nature of the solutes added.

A further advantage of the compressed vegetables is that they have a greater tendency to float 20 on the surface than traditional dehydrated vegetables. This is probably due to their lower bulk density.

Surprisingly unless compressed to an excessive degree the compressed vegetables exhibit surprisingly a marked ability to rehydrate to the initial shape of the fresh vegetable piece.

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#### **Example 1**

Onions with a solids content of 14% were peeled and diced, 10x10mm pieces were dehydrated in a hot air dryer at 70°C to a moisture content of 15%. The partially dried pieces were compressed by passing through a roller mill with a gap of 0.5mm. The semi-dried

passed readily through the mill without sticking or shattering. They were then further dried at 60°C to a moisture content of 5%. When placed in a cup with boiling water poured over them, the pieces were sufficiently rehydrated to consume after one and a half minutes.

**5 Example 2**

Peeled carrots with a total solids content of 12% were diced into pieces 10x4x4mm. The pieces were steam blanched for one minute, then coated with sufficient salt to give a salt content in the final product of 5%. The carrot was dehydrated at 70°C in a hot air dryer to a moisture content of 20%. The pieces were compressed by passing through a roller mill with the gap set at 0.4mm, and then dried further at 70°C to 5% moisture.

When placed in a cup of boiling water and allowed to stand, the carrot pieces were quite tender and sufficiently rehydrated to eat after 2 minutes.

15 Dehydrated vegetables with rapid rehydration times can thus be produced by compressing partially dehydrated vegetables for example by passing through the gap of a roller-mill prior to final dehydration. The increased speed of rehydration can be further increased by the compression of vegetables to which solutes have been added.

20 DATED this 20th day of July 1998

**BYRON AUSTRALIA PTY LTD**

By Its Patent Attorneys

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